

# A career in public health

## The chance to save lives by the millions

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When I began my career, I had no idea where the road would lead but I knew I wanted to do something that would make a real difference in people's lives. I came to understand that in public health, we do have the opportunity to change lives, sometimes millions at a time.

Consider the eradication of smallpox, perhaps the greatest public health achievement of the last century—eliminating a disease that for millennia had killed millions of people around the world. And childhood immunizations—that now protect 80% of the world's children against tetanus, whooping cough, diphtheria, measles, meningitis, hepatitis, pneumonia, and polio—diseases that had once caused misery for millions.

By fortifying foods with folate we prevent birth defects, by fluoridating water we avoid dental cavities, by adding iodine to salt we lessen thyroid problems and mental retardation, by removing lead from gasoline we improve our air quality and reduce lead poisoning in children, and by placing restrictions on smoking, we reduce heart disease and cancer. These are just a few ways public health scientists and policymakers have used research to make a difference.

Work in public health is not merely a job. It is a mission to be approached with passion, competence and commitment. This aspiration defines who we are working in public health.

Sometime during my training in internal medicine, I realized that I was more interested in social issues and in public health than in actually practicing

medicine. By serendipity, a friend mentioned an opening in epidemiology at Oxford. The professor, Sir Richard Doll, saved lives by the millions by establishing the link between smoking, tobacco, and death from heart disease and cancer. Back in the 1950s, he queried all physicians in England about smoking, paid the Registrar General one pound for any death certificate with doctor listed as the profession, and linked their cause of death with their smoking history. The lethal effects of smoking were evident: one third of those who smoked died of their habit, and if they stopped, the risk decreased rapidly. How powerful! So we asked Sir Richard, "What will you do to remove tobacco from the shelves?" "Nothing!" he said. "I am an epidemiologist, not a politician." So today, despite this knowledge about the health risks of smoking, there are still about 6.3 million tobacco-related deaths each year. My generation provided the scientific evidence. It remains for the next generation to help solve this most vexing problem. And the public health tools to do this will not be drugs or vaccines, but partnerships—partnerships with lawyers to frame laws and tax policies, communicators to organize campaigns with social media, and experts in policy and health economics to frame these arguments—all new strategies in the armamentarium of the public health practitioner of tomorrow.

My own path to engage and address health issues has been circuitous. In 1979, I was in the epidemiology program at the U.S. Centers for Disease Control and

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Prevention (CDC), cutting my teeth on outbreak investigations. A cruise ship that had left port with 4,000 healthy passengers was returning from the Caribbean with nearly 1,000 suffering from diarrhea due to salmonella. It was a messy, smelly, contentious investigation. I traced the outbreak to problems of poor hygiene and sanitation, and the company cancelled the next cruise to clean up the ship. But was this to be my legacy in public health? Improving the lot of well-to-do, American tourists on vacation cruises?

With this limited experience with diarrheal diseases, I was offered a position in Bangladesh to work on cholera control, at a time when Henry Kissinger was referring to the country as the “basket case of Asia.” Although skeptical, I discovered it was the best training ground for public health that I could ever have imagined.

I began with studies of cholera, one of the great epidemic diseases of our time, spread by drinking water contaminated with feces. Patients develop diarrhea so severe that they can lose a liter of fluid per hour and die in less than a day. These deaths could be prevented with intravenous fluids, but how do you get these expensive, imported products to patients in far off rural areas? Some clever American and Bangladeshi investigators developed a simple recipe—water, salt, and sugar—oral rehydration solution, ORS, that could be administered by mouth at home or in clinics, even when a patient was purging. ORT could replace what was lost, volume for volume, and the patient would survive. ORT is the recommended treatment for diarrheal disease today, heralded by *The Lancet* as one of the most important discoveries of the 20th century, credited with saving a million lives a year. It clearly demonstrates that research anywhere helps people everywhere. The results of research in global health can be felt around the world—saving millions of lives at a time.

In surveying the causes of diarrhea in the 100,000 patients seen at the hospital each year, we discovered to our surprise, the most common pathogen was not cholera but a newly discovered pathogen, rotavirus. It infects every child worldwide in the first few years of life and kills nearly half a million children per year in



#### About Dr Glass

Dr Roger I Glass graduated from Harvard College in 1967 and received a Fulbright Fellowship to study at the University of Buenos Aires (Argentina). He obtained his MD degree from Harvard Medical School and his Masters in Public Health from Harvard School of Public Health in 1972. Dr Glass joined the Centers for Disease Control and Prevention (CDC) in 1977 as Medical Officer assigned to the Environmental Hazards Branch. From 1979 to 1983 he was a scientist at the International Center for Diarrheal Disease Research in Bangladesh, and then received his PhD from the University of Göteborg, Sweden. He joined the National Institutes of Health Laboratory of Infectious Diseases in 1984, where he worked on the molecular biology of rotavirus. Dr. Glass returned to the CDC in 1986 to become Chief of the Viral Gastroenteritis Unit at the National Center for Infectious Diseases. Since 2006, he has been Director of NIH's Fogarty International Center and Associate Director for International Research.

Dr Glass's research focuses on the prevention of gastroenteritis from rotaviruses and noroviruses through the application of novel scientific research. He has maintained field studies in India, Bangladesh, Brazil, Mexico, Israel, Russia, Vietnam, China and elsewhere. The development and introduction of rotavirus vaccines in the developing world is one of his major concerns.

His research has resulted in the publication of more than 500 research papers and chapters in well-respected scientific journals. He is fluent and often lectures in five languages. During the course of his career, Dr Glass has received numerous honors and awards, including the prestigious Charles C Shepard Lifetime Scientific Achievement Award presented by the CDC in recognition of his 30-year career of scientific research application and leadership, and the Programme for Global Paediatric Research Award for Outstanding Contributions to Global Child Health. He is a member of the US National Academy of Sciences.

low-income settings like Bangladesh. In the U.S., rotavirus accounts for 5% of all hospital admissions for children < 5 years. Since rotavirus infects all children, rich or poor, we needed a vaccine for prevention of deaths in Bangladesh and hospitalizations in high-income countries. So, I refocused my career on the global prevention of rotavirus in children.

It was not until 2006, almost 25 years after I left Bangladesh, that rotavirus vaccines were deemed safe and effective enough to be introduced in the U.S. for the routine immunization of all American children. In 2008, WHO extended this recommendation to all of the children in the world. The impact of this initiative has been incredible: rotavirus hospitalizations

have decreased 95% and hospitalizations for children under 5 years have decreased in the U.S. and in other high-income countries. In developing countries, we have begun to see deaths from diarrhea decrease as well.

Scientific advances certainly require good ideas, hard work and perseverance. But I've found serendipity, personal relationships and good partnerships can also play a significant role.

In 1985, I traveled to Calcutta for a WHO meeting on diarrheal diseases, where I met a young Indian pediatrics professor, Dr. Maharaj “Raj” K. Bhan. Since we were housed at a convent with strict rules forbidding alcohol, we decided to leave the premises together for a drink.

Our casual conversation that night spawned nearly three decades of fruitful collaboration. In May 2013, it was my pleasure to join Raj and our now many other partners in New Delhi to review the results of a clinical trial of an affordable and effective rotavirus vaccine that is the result of this unplanned meeting nearly 30 years ago.

During that long-ago happy hour, Raj mentioned he was following a rotavirus outbreak in the newborn unit at the All India Institute of Medical Sciences (AIIMS). He noted it was surprising that infected neonates didn't develop diarrhea. At the time, I was working on an effort at the U.S. National Institutes of Health (NIH) to study an unusual group of rotaviruses collected from newborns on four continents that also did not cause the disease. And so began our joint efforts to see if these infections could protect children against subsequent severe rotavirus disease.

After three years of informal collaboration, the Indo-U.S. Vaccine Action Program (VAP) was launched by the Indian Department of Biotechnology and NIH's National Institute of Allergy and Infectious Diseases and our project was approved for funding. Further study of the AIIMS strain of rotavirus indicated it was safe in adults and that it might be a good candidate for a vaccine for children. In 1998, a meeting organized by VAP brought investigators together with a group of Indian vaccine manufacturers, including Dr. Krishna Ella, CEO of Bharat Biotech. His enthusiasm was infectious and we began the vaccine development process.

There have been bumps along the road and many wonderful partners joined the project—most importantly the Bill & Melinda Gates Foundation and a program at PATH. By 2011 we were finally ready to launch a trial with 6,800 infants at three sites in India conducted by an NGO, the Society for Applied Studies, which grew out of the need for larger field trials. Thankfully, the results have been positive. We hope the vaccine will be licensed so

that it can be introduced in several sites in India. We're confident this will make a huge impact and go a long way to preventing the 100,000 rotavirus deaths that currently occur in that country every year.

We've accrued other benefits during this long and winding journey. As we studied the epidemiology of rotavirus in India, we discovered vast differences in the epidemiology of disease between low- and high-income settings. We learned there are more diverse rotavirus strains circulating in India at any time than anywhere else in the world and that Indian children are more likely to be infected with several strains rather than a single strain. While rotavirus infections are highly seasonal in the U.S. and Europe, they occur year-round in India. Eighty percent of Indian children are infected in the first year of life with fatalities occurring for about 1 in 200.

Through our many years of partnership, we also provided more than a dozen investigators and young scientists with significant research training, which has prepared them to tackle other remaining health challenges.

Finally, it's significant that this new vaccine was derived from an Indian strain, identified by an Indian scientist, developed by an Indian company, studied in Indian populations, with support from the Indian government. It's likely the first entirely new vaccine developed in India in over 100 years! There is still much to be done to take this vaccine to India's children—but I am encouraged this will have an immediate and considerable impact on reducing the global burden of rotavirus and rotavirus associated mortality.

In my position as director of the Fogarty International Center, part of the NIH, I oversee a diverse portfolio of research and research training programs aimed at improving health, especially in low-resource settings. One of my favorite programs sends young people, early in their careers, overseas to pursue a year of mentored research in a developing

country. As it did for me, this experience often alters their career path and sends them on a quest to solve a pressing global health problem. Other Fogarty programs support research training to build scientific expertise in a broad range of topics such as HIV/AIDS and other infectious diseases; chronic conditions such as cancer, heart disease and diabetes; informatics to construct and interpret massive data sets, bioethics so that clinical trials meet international standards, and implementation science—translating what we know into what we do. In addition, we fund research projects to study brain disorders and mental illness; the ecology of infectious diseases; biodiversity and natural products discovery; and tobacco control.

Everywhere I travel, scientists approach me as if we were old friends and tell me their stories of how Fogarty training helped launch their careers. Our alumni include the Ministers of Health in Taiwan and Hungary, directors of AIDS programs in Brazil and China, senior health officials at the U.N. and other bodies. This training has had a significant impact—advancing the global health research agenda, creating agents of change and developing the next generation of leaders.

It is extremely gratifying to lead this small center with such extraordinary staff and grantees and that has such immense global reach. Never in my wildest imagination did I think I would be so fortunate to lead such an organization or that I would spend my entire career studying enteric infections. But this journey has been incredibly rewarding—I have engaged with global health philanthropist Bill Gates, who now sees rotavirus vaccines as one of his priorities, with the head of the World Health Organization, global leaders and politicians, and field staff working the trenches of immunization programs around the world. Together, we are working to save lives, sometimes millions at a time!